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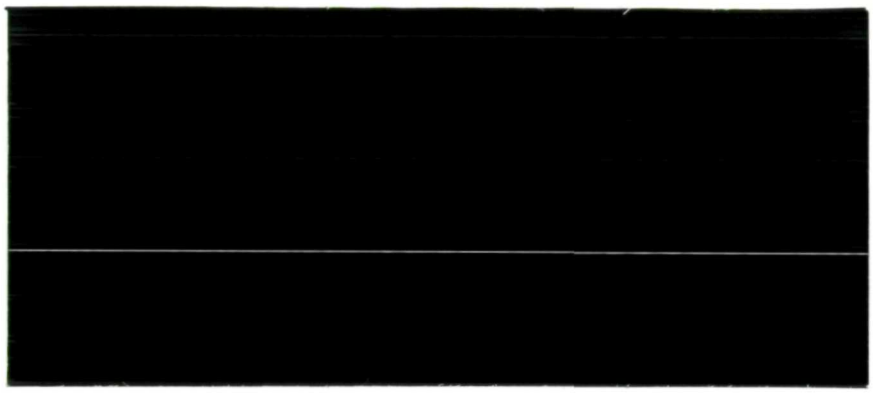

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Collection and Measurement of Atmospheric Contaminants During Skylab AM/MDA Unmanned Altitude Chamber Test

Final Report on Contract NAS 9-11960

To

NASA MANNED SPACECRAFT CENTER

Houston, Texas

DECEMBER 1972

REPORT NO. 3003-F-1

ANALYTICAL RESEARCH LABORATORIES, INC.

Monrovia, California

CONTRACT FULFILLMENT STATEMENT

This final report is submitted to National Aeronautics and Space Administration Manned Spacecraft Center in completion of Contract NAS 9-11960. It describes the analytical data derived from and test preparation for studies of the Skylab AM/MDA unmanned altitude atmospheric contamination survey.

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Monrovia, California 91016

Technical data contained in all of the pages of this report furnished in connection with Contract NAS 9-11960 shall not be used or disclosed, except for evaluation purposes, provided that the government shall have the right to use or disclose this technical data to the extent provided in the contract. This restriction does not limit the government's right to use or disclose any technical data obtained from another source without restriction.

FOREWORD

This report completes the requirements of NAS 9-11960 and comprises the analytical data obtained from both cryogenic and grab sampling of the atmosphere of the Skylab AM/MDA during an 84 hour unmanned altitude chamber run performed at McDonnell-Douglas, East, St. Louis, Missouri in July 1972. The analytical work was performed at the Analytical Research Laboratories, Inc. facilities in Monrovia, California. Messrs. C. L. Deuel acted as project engineer and assisted in sampling and gas chromatography, H. Harper and A. Bogaardt performed both sampling and gas chromatography duties, and N. Hultgren was mass spectroscopist and mathematician for data reduction. Mr. M. L. Moberg was project manager.

The cooperation of the McDonnell-Douglas and NASA personnel was much in evidence and vital to the successful completion of this task. McDonnell-Douglas personnel who were especially helpful included. J. Guenther and R. Smith from government stores, Terry Bartels of the laboratory, and Joe Beasley, test engineer. L. J. Lewandowski NASA Q. A. representative and Bob Holman representing NASA, MSC provided invaluable assistance.

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I. INTRODUCTION AND SUMMARY

Contract NAS 9-11960 was granted to Analytical Research Laboratories, Inc. to perform an atmospheric contamination study of the skylab multiple docking assembly during the unmanned altitude phase of the preflight test program. This contract required refurbishing the necessary hardware for sampling, performing on-site sample collection, utilizing the manned space flight center modified cryogenic sampler, analyzing the collected samples, and reporting results.

Three types of samples were taken from three specified locations at the module site over an 84 hour test period. The samples included grab samples or samples taken momentarily from the gas flow system of the sampler, cryogenically collected samples (water ice trapping, Dowanol dry ice trapping, and liquid nitrogen trapping), and samples adsorbed on activated charcoal. Following the requirements of the contract, the altitude chamber was sampled from three positions identified as "A", "B" and "C." The forward portion of the cabin was sampled through port "A", the middle point at position "B" and the aft tunnel compartment at sample port "C." Grab samples were taken at 4 hour intervals throughout the 84 hour test period from position "B." At 8 hour intervals, grab samples were also taken from positions "A" and "C." Cryogenic samplings were continuously taken throughout the test from position "B." The cryogenic traps were changed at 8 hour intervals. All interconnecting passages remained open during the unmanned test in an attempt to derive uniformity in the atmosphere of the altitude chamber. Sample position "B" was therefore selected as representing the atmosphere throughout the altitude chamber and received the greater number of samplings. The occasional sampling from points "A" and "C" were made as verifying analyses and for possibly identifying potential contaminant sources located in positions other than the center of the chamber.

The analytical results can be summarized as follows: There were no clear trends of increasing or decreasing contaminant levels during the test. However, some generalizations can be made from the data as presented in the attached tables. The xylenes were more evident in the "C" series samples. In contrast, benzene and toluene were generally higher throughout the test at the "A" and "B" locations. The cryogenically collected samples taken at position "B" (Table 1) showed three general cycles in contaminant levels. The maxima of these cycles appeared to have occurred in the initial sample, some point in time near the 40th hour, and later near the 60th hour. The cycle was most evident with benzene and to a lesser extent in the concentrations of Freon 113 and tetrachloroethylene. Several of the alcohols and the total concentration of contaminants as shown in this table suggests the same trends. The grab sample analyses showed similar trends but there were more inconsistencies and spurious higher values on several of the samples. This would not suggest that grab sampling was ineffective or that the sample cylinders had acquired leaks because the major component analyses of the grab samples showed a very consistent level of oxygen and nitrogen near the designed level. Only two of all the grab samples were inconsistent in these elements. The first, the MDA Center sample before the 84 hour test as shown in Table 2, had a high nitrogen value, and the sample taken at the 60th hour was disproportionate in nitrogen and oxygen concentrations compared to the other grab samples. There were 96 compounds identified in all of the samples. Less than 10 of these, however, consistently reached ppm levels during the test program.

II. TECHNICAL DISCUSSION

The atmospheric sampling program for the Skylab AM/MDA was divided into four phases; these will be separately discussed.

Phase 1, the pretest period, involved the preparation and refurbishing of sampling hardware and validation of the system; Phase 2 describes the sample acquisition; Phase 3 consisted of analyses and data reduction; Phase 4 was devoted to reporting, describing various nonmetallic sources for types of contaminants and preparation of a collection system for the OWS atmospheric sampling program.

A. PHASE 1

The Manned Spaceflight Center provided the Analytical Research Laboratories with 94 sample collection cylinders for disassembly, reconditioning, cleaning, reassembly, and testing. Of these, 84 were successfully reconditioned and met the leak tests as described in the contract. The contract requirements were that the sample collection cylinders should have a leak rate less than 10^{-6} standard cc's/sec. at a pressure of 10^{-4} torr as indicated by the leak detector measuring device. The ten remaining cylinders were held at the Analytical Research Laboratories until the conclusion of the program and returned with the other cylinders to the Manned Spacecraft Center. The reconditioning of the cylinders for collection use included, disassembly, ultrasonic and solvent cleaning, replacement of some of the control valves, replacement of the nuts and ferrule fittings, replacement of the Viton O-rings and teflon seats, replacement of diaphragms as required, reassembly, valve parts lubricated with Krytox as required, thermally vacuum treated for 24 hours and purged with hot-dry helium. Prior to leak testing each sample cylinder was evacuated for more than four hours before leak testing. The cryogenic sampler owned by NASA was modified by NASA-MSC personnel to provide charcoal trapping capability. This laboratory

provided a representative to the Houston facility to review with NASA personnel the flow configuration, connections, vacuum tightness and efficacy of trapping. Following this rather intensive review the sampler was certified as leak free and suitable for cryogenic and grab sampling.

Two pretest trips were made, by the laboratory representative, to McDonnell Douglas, St. Louis to establish suppliers for the necessary expendable materials for the test and to perform the preliminary connections and testing of the collector system. Dowanol, TM was secured locally (St. Louis area) for the liquid media of the dry ice trapping system. This material had a sufficiently low pour point, -84°C, for this application. Procedural arrangements for the test operations were established with the personnel at the McDonnell Douglas Corporation during these visits.

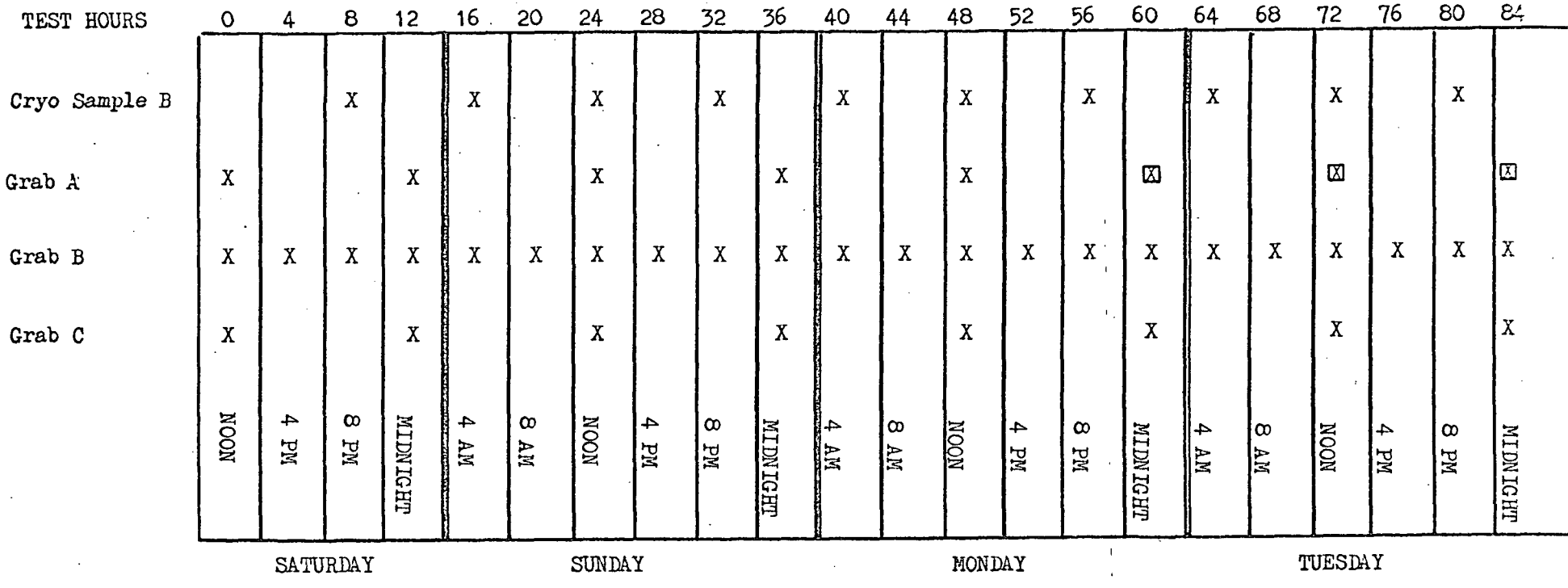
The sampler and sample line efficiency was tested according to the contract requirements by introducing a selected gas mixture containing 25 ±2 ppm of the following materials in helium, Freon 113, butane, benzene, acetone, ethyl alcohol and ethyl acetate. The transfer and trapping efficiency tests were made with a line pressure of 5 psia. at approximately 150°F. As suggested by Dr. E. Harris the on-site technical director, grab samples were taken during this test and the analyses were performed by the McDonnell Douglas Laboratories. Following the integrity testing of the sampling system the sampling lines were cleaned with hot nitrogen gas for a period of four hours. To confirm the absence of the induced contaminates, a sample of gas was analyzed by infrared spectrophotometry using a long-path gas cell. This test was also conducted by the McDonnell Douglas personnel. No contamination was detected above 1 ppm.

B. PHASE 2

According to the contract ARLI technical personnel went to McDonnell Douglas, St. Louis in advance of the scheduled unmanned altitude

chamber test to assist NASA and McDonnell Douglas personnel in expediting the preparations of the test. The assistance provided for the MSC field test engineer included, the expediting of flow and vent systems, installing and testing vacuum and high gas purge lines with suitable bypasses for the sampler, sampling the oxygen and nitrogen supply systems for McDonnell Douglas Laboratory analysis, providing assistance to McDonnell Douglas test personnel on attaching their control console to the altitude chamber system, dispatching supply orders, and locating the necessary parts such as thermocouples and special fitting connections for the altitude test program. The principal task for ARLI's representatives was, of course, the collection of the samples during the 84 hour test period. Before use, each cylinder of supply gas was analyzed for mercury contamination by the McDonnell Douglas Laboratory. This information was supplied directly to the NASA field test representative as verbally authorized by the NASA test program engineer Dr. E. Harris. In order to meet the test schedule described in the contract under Phase 2, Part 4.2.1 and 4.2.2., a work operations schedule was established for the three ARLI field personnel. The schedule was divided into 8 hour work shifts with sufficient overlap that no individual was required to operate more than 4 hours without assistance. There were two men provided for start up and shutdown operations where sampling and time limitations were more critical. The sampling schedule was followed precisely as the contract required indicating sampling at all three positions and grab cryogenic and charcoal sampling throughout the 84 hour test. The specified number of samples were taken and in addition other special samples were taken to verify possible changes of equipment or operational conditions. Three samples were directed to the laboratory before completion of the test program to verify the contaminant concentration level. This information was forwarded to the program manager by telecon during the test program.

SAMPLING SCHEDULE



⊠ CRITICAL SAMPLES - ANALYSIS WITHIN 24 HOURS

Figure 1

The complete test log operation of the altitude chamber was developed and retained by McDonnell Douglas personnel. Because of the lack of telephone communications of the chamber operation, no indications of mechanical change during the test period was provided for this laboratory. Pressure readings on the sample were taken at one-half hour intervals to establish successful operation of the sampler throughout the test. These data were constant throughout the program.

At 11:30 hours on 21 July, the chamber door was closed and pump down was begun. At 12:15, the chamber was returned to ambient pressure the door opened and McDonnell Douglas personnel entered the chamber to repair the oxygen and carbon dioxide readout system. At 12:45 the chamber was again brought to altitude. This was achieved at 13:20 and an initial grab sample taken representing this point of the program. This sample was forwarded to the Analytical Research Laboratories for analysis as well as a second sample furnished to the McDonnell Douglas Laboratory for on-site testing. At 11:55 a.m. on 22 July the 0 hour grab sample was taken and the 84 hour test period started. During each shift, the operator packaged the sample bottles in air pack material and sealed them in individual containers. Four of these boxes were packed to a case and each case was sent by air cargo to the Analytical Research Laboratories for analyses. Critical samples were hand carried by ARLI personnel on their return trip. Following the 84 hour test the technical people returned to the laboratory except for one person. This person remained on-site to package all GFE equipment for delivery to the government holding area at McDonnell Douglas, The Analytical Laboratories' equipment was also packed for later shipment to California. The sampling schedule is shown in Figure 1.

C. PHASE 3

Sample processing was started as soon as the samples were received by the laboratories (within 12 hours). The analyses of all

grab samples were completed before the cryogenically trapped samples were started. The results of the three critical grab samples were timely forwarded to the MSC program office by telecon according to the contract.

At ARLI, each sample was split on a specially designed stainless steel vacuum rack. Four aliquot fractions were taken, two reserved for gas chromtographic analyses, one for direct mass spectrometry or spectrometric study, and one was retained as a reserve sample. The analytical procedure and sampling procedure was the same as that reported under NASA contract NAS 9-8872.

At the request of the program office, methane and carbon monoxide were measured on selected grab samples. Samples selected for this additional information were somewhat random but represented the test period throughout the time interval. These measurements were made by using the Sabatier reaction system (Raney nickel catalysis) in conjunction with a 5A molecular sieve column and a flame ionization detector. In this scheme methane elutes from the 5A column and is measured as methane. Carbon monoxide is converted to methane on the catalytic bed and the FID indicates carbon monoxide as a methane signal. This detection system and converter have been calibrated with varying amounts of carbon monoxide, carbon dioxide, methane, and other hydrocarbons in the ppm range. After completion of all analyses, the data calculated and reported, sample cylinders were returned to the Manned Spaceflight Center. This included the 84 cylinders used in the test program as well as the ten remaining cylinders held at the laboratories and other parts and materials furnished by NASA that were unused.

For comparative purposes the laboratory assembled all of the analytical data on one large table. With this table, concentration trends of the various contaminants throughout the 84 hour test could be

more conveniently observed. Tables 1-5 reflect the information displayed on the preliminary tabulation. For convenience of the program, however, the contaminants are displayed or reported according to structure and molecular size, the first components in each listing generally indicates the first compound in each homologous series with increasing molecular weights.

III. RESULTS AND CONCLUSIONS

A. INTRODUCTION

Using and understanding the analytical data collected from all samplings can be as complex as determining the values if these data are not presented in a well defined manner. The format chosen for presenting these collected data as shown in Tables 1-6 was by classification. For the halocarbons within a single carbon value, the number of chlorine atoms or fluorine atoms increase as the table progresses. Other classes of compounds such as the hydrocarbons, heterocyclics, alcohols, acids, ketones, esters and miscellaneous classes followed molecular weight. Table 1 presents the data collected from the cryogenic samplings at "B" from 0 time to the 80 hour. At the end of each table, the total weight of contaminants in milligrams per cubic meter are presented. Each column represents the combined contaminants from the three traps of each cryogenic collection i. e., the water ice trap, the Dowanol carbon dioxide trap, and the liquid nitrogen trap. Table 2 presents the data obtained on each grab sample taken at "B" every fourth hour throughout the test. Presentation is given in the same manner as for the cryogenic data. At the end of Table 2, the major components of each sample are given as an indication of the integrity of the sample and general composition of the altitude test chamber. Table 3 contains the data obtained on the grab samples taken from "B" of the altitude test chamber. Table 4 represents the analytical information collected on the grab samples taken at "C" of the altitude test chamber. Table 5 represents the methane and carbon monoxide analyses of the selected grab samples. Table 6 covers the components desorbed from the charcoal collection system.

The cryogenic sampling should represent the most reliable and informative collection of material because of its time integrating capability. Even with this selection there are weaknesses that are often better observed in the instantaneous grab collection method. For example, the noncondensibles are essentially lost through cryogenic trapping although there is some adsorption, and/or occlusion continuously occurring. Also, measurement of very small signals by chromatographic FID systems with instantaneous sampling (1 to 2 minutes), compared to large responses obtained from cryogenic sampling over an 8 hour period, can cause serious quantitative problems. Fortunately, FID is essentially linear through the concentration ranges used for this sampling system. The following paragraphs describe some of the observations of these data in more detail.

B. CRYOGENIC SAMPLES

1. Halocarbons

The analytical data obtained on all cryogenically collected samples have been tabulated according to structural classes. In general, it appears that the concentration of the halocarbons increased near the midpoint of the test. If there were perturbations in the atmospheric controlled conditions, they were not obvious in the concentration of this family of contaminants. This does not suggest that the purification system was improperly functioning, but rather, that its effectiveness was not noticeable according to the halocarbon concentrations except toward the end of the 84 hour test.

2. Aromatics and Aliphatics Hydrocarbons

Trends in the concentration of these compounds would appear to be somewhat more consistent. While fewer compounds were found in the first sample, several compounds e.g., benzene, propane,

and methylcyclohexane, were slightly higher. During the test some compounds showed marked reductions in concentrations. The more common hydrocarbon solvents such as benzene, toluene and xylene, remained moderately consistent in concentration throughout the test with the exception of the three cycling conditions as noted earlier.

3. Alcohols

Ethyl, isopropyl, and the isomers of butyl alcohols were the major volatile ones observed in this study. The concentrations of these alcohols were noticeably higher when compared to Apollo charcoal desorption studies. Other higher boiling alcohols were less evident in the collected sample although capryl, cyclohexyl, 2-hexyl alcohol, and ethylene glycol were observed at moderate concentrations. These data were confirmed by mass spectrometry. The concentration of the higher molecular weight alcohols were less than the three common low molecular weight alcohols and this may or may not represent the actual chamber atmosphere. Obtaining true concentration levels of higher molecular weight polar compounds is extremely difficult if the sampling train offers adsorption sites that will retain polar materials. ARLI personnel were informed by the technical staff at McDonnell Douglas that many of the fixtures going into the altitude chamber had been cleaned with the lower molecular weight alcohols in preference to Freon 113. This may be the principal source of the alcohol contamination.

4. Aldehydes, Ketones, Esters, and Miscellaneous Compounds

Methyl ethyl ketone, methyl acetate, and methyl isobutyl ketone were the most significant contaminants in these classes. Their presence would suggest significant outgassing of epoxy-potted components, paints, and adhesives that use these ketones as solvents. Acetaldehyde could be a degradation product of certain polyamides and paint vehicles.

Finally the total collected materials expressed as mg/M^3, reflect chamber contaminant variations better than changes in the concentration of individual compounds. Two peak contaminant concentrations occurred in this test as mentioned earlier in the summary. A marked decrease in contaminant concentration was indicated after the 64 hour period and through to the end of the test program.

C. GRAB SAMPLING

Grab sampling represents only a momentary picture of the chambers' contaminant levels. However, noncondensibles as well as all other materials are equally sampled. Samplings from various positions within the chamber represent more complete chamber history. As mentioned earlier, the sample positions were in the forward, center and aft locations of the altitude test chamber. The sampling plan was developed in order to collect representative samples from all three sections of the high altitude chamber without excessive analytical costs. Grab samples were taken from each of the positions. Three sampling positions are indicated in three separate tables, 2, 3, and 4. Because of the number of samples taken from the B position, Table 2 is divided into test numbers as well as classes, page 1 of Table 2 is continued through the 84 hour test on page 2. Page 3 of Table 2 continues with a class of compounds from 0 time through the 36 hour period, while page 4 of Table 2 continues through the 84th hour. The same conditions follows for the remaining data of "B" grab samples. Because of the sampling frequency, 12 hour intervals, from points "A" and "C", each data sheet covers the entire test period.

The data presented in Tables 2-4 are less consistent than those shown in Table 1. It is suggested that the total volume of atmosphere sampled i. e., one minute compared to 8 hours, for a factor of

approximately 500 to 1 will affect the quantitation of the separate numbers. However, the contaminants observed in cryogenic collection at low concentrations should not be observed because of the 500 to 1 concentration factor between the two collection techniques. Some of the spurious values indicated in the grab samples may be the result of atmospheric heterogeneity, or perhaps desorption of the sample flow lines during the high flow rate grab sampling. In general, compounds that were found in significant (trace) amounts in the cryogenic traps were also observed as major contaminants in the grab samples. These would be Freon 113, methylchloroform, trichloroethylene, benzene, toluene, some of the butenes, ethyl and isopropyl alcohol, acetone, methyl ethyl ketone, and methyl isobutyl ketone. The major atmospheric components are also shown in Table 2-4. The concentration of carbon dioxide varied from an undetectable mass spectrometric level i. e., 10 ppm's, to approximately 1,000 ppm. The source of this contaminant is not known although it might indicate the introduction of small quantities of air into the altitude chamber rather than contamination of the supply gas, consisting only of nitrogen and oxygen. The presence of argon might confirm this observation although argon is the major impurity in commercial breathing oxygen.

The selected grab samples were analyzed directly for methane and carbon monoxide as previously mentioned. Concentrations of methane remained rather uniform throughout the 84 hour test except for the final sample. The reported values, averaging near 5. 5 ppm, appear to be normal for an unmanned sealed chamber containing organic coatings and components. The final value of 11 ppm may be the result of activating a charcoal scrubbing system attendant with degradation of some adsorbed organic compounds. Carbon monoxide concentrations varied from 2 to near 30 ppm as the test program progressed. Position "A" changed from 4. 6 to 10. 7 to 23. 0 from 24 to 84 hours while position "B" increased from 2 to 5

ppm starting at 12 hours and going to a midpoint near 48 hours. Two values are given for position "C" sampling; these are 28 and 14 ppm representing the 36 and 48 hour samples. Chamber air circulation and charcoal purification (with some degradation) might account for these somewhat unusual values.

The data presented in Table 6 covers the components desorbed from the charcoal scrubbers. These data describe compounds desorbed from unexposed charcoal (blank), charcoal removed from the, two life support system canisters located within the chamber during the 84 hour test, and charcoal from the auxiliary trapping system used in conjunction with the cryogenic traps.

The desorbates from these charcoals are in general agreement with the gas sample data. The canister samples both showed a large number of halogenated hydrocarbons that appear to be associated with Freon 113 degradation on charcoal, that were not detected on either the blank or cryogenic charcoal samples and were not present in the gas samples. The canister samples also contained a greater number of hydrocarbons than were noted in other samples from this series (possibly adsorption/desorption degradation production). The blank charcoal had less than 1 μg/g of total contamination desorbate, which compares favorably with vacuum-thermally cleaned charcoal.

The contaminate concentration level of the cryogenic charcoal would be comparable with that of canister 30-111 if the relatively high unexplained Freon 11 level (MS verified) of 9.1 μg/g is not included. The MEK content is higher than the canister samples, and this supports to a degree, the relatively large quantities observed in the gas cryogenically collected samples.

The alcohols are higher than found in Apollo charcoal desorbates but were similar to the concentrations found in the cryogenically

collected samples. Possibly some significance in canister location within the chamber could be found as results are compared with the grab and cryogenically collected materials. These data and canister locations were directly transmitted from McDonnell Douglas to the NASA program office.

The data reported in Table 7 describes the contaminant composition of the chamber supply gas. From these data we can conclude that some of the principal contaminants found in the chamber are, a direct result of a continuous input of oxygen (and its contaminants) to the chamber. Particularly, concentrations of the solvents methyl ethyl ketone, the lower alcohols, toluene and Freon 113 would appear to be similar to the information shown in Tables 1 - 4.

Table 1

Skylab AM/MDA

Cryogenic Samples of Atmospheric Contaminants from Unmanned Altitude Run

(mg/m^3)

Compound	Cryo"B" 0-8th hr.	Cryo"B" 8-16th hr.	Cryo"B" 16-24th hr.	Cryo"B" 24-32nd hr.	Cryo"B" 32-40th hr.	Cryo"B" 40-48th hr.	Cryo"B" 48-56th hr.	Cryo"B" 56-64th hr.	Cryo"B" 64-72nd hr.	Cryo"B" 72-80th hr.
Halocarbons										
1,1,1-Trichloroethane	-	-	-	-	-	-	0.80	-	-	-
Carbon Tetrachloride	-	0.051	0.016	0.017	-	0.092	-	0.046	0.061	0.0012
Chlorobenzene	-	-	-	-	-	-	0.0027	-	-	-
Chloroform	-	0.0032	0.083	0.18	-	0.14	3.2	0.91	0.0003	-
Dichlorobenzene	0.0028	0.0046	0.16	0.011	0.0028	0.0086	0.0034	0.12	0.00005	0.00014
Dichloroethane	-	-	-	-	-	0.00054	-	0.0018	-	-
Fluorochloroethylene	-	-	-	-	-	0.0047	-	0.00056	-	-
Freon 11	0.26	0.55	0.32	0.27	0.26	-	0.024	0.0041	0.044	0.11
Freon 12	-	-	-	-	-	-	-	-	0.0039	-
Freon 113	1.2	0.92	0.48	1.5	1.2	1.4	0.59	1.2	1.2	0.80
Methyl Chloride	-	0.011	0.0092	0.00061	-	0.0018	0.0014	0.0023	0.0039	0.00081
Methyl Chloroform	0.70	0.34	0.35	0.42	0.70	0.51	-	1.1	0.42	0.15
Methylene Chloride	2.7	0.43	0.15	0.52	2.7	0.15	0.064	0.047	0.072	0.051
Tetrachloroethylene	0.013	0.84	0.32	1.6	0.013	1.1	13.	6.9	1.3	0.84
Trichloroethylene	8.9	5.5	2.7	2.9	8.9	2.0	2.3	6.5	3.2	2.2
Vinylidene Chloride	0.0086	-	0.013	-	0.0086	0.022	0.00001	-	-	-
Chlorodifluoroethylene	-	0.00002	-	-	-	-	-	-	-	-
Aromatics										
Benzene	3.5	0.98	0.25	0.49	3.5	1.3	0.26	1.7	0.63	0.28
C-10 Aromatics	-	0.0046	0.14	0.023	-	0.0023	0.067	0.00060	0.13	0.035
C-11 Aromatics	-	0.0042	-	-	-	0.054	-	-	0.0068	-
Cumene	-	-	-	-	-	-	-	-	-	0.00024
Ethyl Benzene	-	-	-	-	-	-	-	-	-	-
Indene	-	-	0.0027	0.0049	-	0.022	0.00015	0.041	0.0063	0.0073
Mesitylene	-	-	0.092	0.022	0.022	0.0077	0.00038	0.040	0.022	0.0068
n-Propyl Benzene	-	0.0010	-	0.046	-	0.0051	0.054	-	-	-
Styrene	-	-	-	-	-	-	-	-	-	-

Table 1 (Cont.)

Skylab AM/MDA

Cryogenic Samples of Atmospheric Contaminants from Unmanned Altitude Run

(mg/m^3)

Compound	Cryo"B" 0-8th hr.	Cryo"B" 8-16th hr.	Cryo"B" 16-24th hr.	Cryo"B" 24-32nd hr.	Cryo"B" 32-40th hr.	Cryo"B" 40-48th hr.	Cryo"B" 48-56th hr.	Cryo"B" 56-64th hr.	Cryo"B" 64-72nd hr.	Cryo"B" 72-80th hr.
Toluene	0.69	1.6	0.65	1.1	0.69	0.71	2.9	1.8	1.1	1.3
Trimethyl Benzene	-	-	-	0.0028	-	0.38	0.025	0.074	-	0.0032
p-Xylene	0.19	0.22	0.097	0.37	0.19	0.26	0.44	0.98	0.28	0.17
o-Xylene	0.068	0.11	0.039	0.17	0.068	0.093	0.12	0.48	0.14	0.088
m-Xylene	-	-	-	-	-	-	0.00002	-	-	-
Aliphatics										
Acetylene	-	0.0006	0.00065	-	0.0012	0.0037	0.00011	0.011	0.0064	0.00084
1 3-Butadiene	0.0012	0.0033	0.0070	-	0.014	0.0015	0.0023	-	0.0014	0.00005
Butane	0.031	0.024	0.057	0.012	0.031	0.0033	0.0046	0.025	0.038	0.024
1-Butene	0.0041	-	-	-	0.0041	-	-	-	-	-
2-Butene (cis)	-	0.00003	0.018	0.0021	-	-	-	-	0.011	-
2-Butene (trans)	0.0085	0.022	-	-	0.0085	0.0004	0.0011	0.091	0.0024	-
Cyclohexane	-	-	-	-	-	-	-	0.0067	-	-
Cyclohexene	-	-	-	-	-	-	-	-	0.0062	-
Cyclopentene	-	-	-	-	-	0.040	-	0.0077	0.0077	-
Dimethyl Cyclohexane	-	-	-	-	-	0.0087	-	-	-	-
2, 3 Dimethyl Pentane	-	-	-	-	-	-	-	-	-	-
Ethane	0.015	0.0077	0.0085	0.00032	0.015	0.0097	0.13	0.0091	0.031	0.0079
Ethylene	-	-	-	-	-	-	-	0.00038	-	-
n-Heptane	<0.0002	-	-	-	<0.0004	-	-	0.087	-	-
n-Hexane	0.15	0.14	0.13	0.17	0.15	0.056	0.18	0.25	0.18	-
Hexene	-	-	-	-	-	-	-	-	-	-
Isobutane	-	-	-	-	-	-	-	0.00046	-	0.028
Isopentane	-	-	0.0023	-	-	-	-	-	-	-
Isoprene	0.051	0.0013	0.023	-	0.051	-	-	0.0049	0.00010	-
Methyl Acetylene	-	0.0015	-	-	-	-	-	-	-	-
Methyl Cyclohexane	0.20	0.055	0.0026	0.0067	0.20	0.00012	0.13	0.26	0.035	0.13
Methyl Cyclopentane	0.10	0.072	0.041	0.037	0.10	-	0.46	0.18	0.072	0.015
1-Pentene	-	-	-	-	-	-	-	0.0045	-	-
Propadiene	-	0.054	-	-	-	-	-	-	-	-

Table 1 (Cont.)

Skylab AM/MDA

Cryogenic Samples of Atmospheric Contaminants from Unmanned Altitude Run

(mg/m^3)

Compound	Cryo"B" 0-8th hr.	Cryo"B" 8-16th hr.	Cryo"B" 16-24th hr.	Cryo"B" 24-32nd hr.	Cryo"B" 32-40th hr.	Cryo"B" 40-48th hr.	Cryo"B" 48-56th hr.	Cryo"B" 56-64th hr.	Cryo"B" 64-72nd hr.	Cryo"B" 72-80th hr.
Propane	0.091	0.029	0.015	0.021	0.091	0.038	0.0036	0.030	0.032	0.019
Propylene	0.0038	0.0034	0.0026	0.00004	0.0038	0.0013	0.00014	0.00014	0.00078	-
n-Octane	-	-	-	-	-	-	-	-	-	-
Trimethyl Hexane	-	-	-	0.0018	-	-	-	-	-	-
Heterocyclics										
Dioxane	0.47	0.32	0.12	0.46	0.47	0.25	0.51	0.61	0.34	0.29
Furan	0.063	0.13	0.089	0.038	0.063	0.034	0.15	0.15	0.071	0.065
Tetrahydrofuran	-	-	-	-	-	-	-	0.28	-	-
Alcohols										
n-Amyl Alcohol	0.034	0.012	0.0026	0.17	0.034	0.021	0.045	0.11	0.060	0.0010
Allyl Alcohol	-	0.0003	0.062	-	-	0.090	0.0038	-	0.14	-
n-Butyl Alcohol	0.26	0.11	0.041	0.20	0.26	0.13	0.40	0.33	0.17	0.17
s-Butyl Alcohol	-	-	-	-	-	-	-	-	-	-
Capryl Alcohol	0.0053	0.0058	0.0017	0.025	0.0053	0.011	0.0074	0.072	0.0036	0.0079
Cyclohexyl Alcohol	0.0014	-	0.0028	0.0029	0.0041	0.011	0.030	0.00096	0.0037	0.0033
Ethyl Alcohol	9.1	1.4	0.78	1.8	9.1	1.0	4.0	1.9	1.3	0.92
Ethylene Glycol	-	0.010	0.0062	0.041	-	0.0088	0.00081	0.037	0.0077	-
2-Ethyl Hexyl Alcohol	0.018	0.0062	0.038	0.015	0.018	0.077	0.00015	0.11	0.00066	0.011
2-Hexyl Alcohol	-	-	0.0019	0.014	-	-	0.0028	0.11	0.065	0.0032
Isoamyl Alcohol	0.010	0.0040	-	0.037	0.010	0.0083	0.026	-	0.071	0.043
Isobutyl Alcohol	0.55	0.064	0.076	0.070	0.55	0.33	0.20	0.21	0.15	0.077
Isopropyl Alcohol	12.0	2.2	0.75	3.6	12.0	1.8	2.7	2.3	2.1	1.4
Methyl Alcohol	0.0007	0.070	0.039	0.00012	0.0007	0.0013	0.010	0.18	0.034	-
n-Propyl Alcohol	0.70	0.45	0.18	0.40	0.70	0.37	0.18	0.41	0.34	0.24
t-Butyl Alcohol	-	-	-	-	-	-	-	-	-	-
Aldehydes										
Acetaldehyde	0.90	0.43	2.3	0.26	0.90	0.27	0.14	0.53	0.48	-
Acrolein	0.0079	-	-	-	-	-	-	-	-	0.30
Propionaldehyde	-	-	-	-	-	-	-	-	-	-

Table 1 (Cont.)

Skylab AM/MDA

Cryogenic Samples of Atmospheric Contaminants from Unmanned Altitude Run

(mg/m^3)

Compound	Cryo"B" 0-8th hr.	Cryo"B" 8-16th hr.	Cryo"B" 16-24th hr.	Cryo"B" 24-32nd hr.	Cryo"B" 32-40th hr.	Cryo"B" 40-48th hr.	Cryo"B" 48-56th hr.	Cryo"B" 56-64th hr.	Cryo"B" 64-72nd hr.	Cryo"B" 72-80th hr.
Ketones										
Acetone	1.9	0.90	2.0	0.90	1.9	0.89	0.98	2.4	1.7	1.5
Methyl Ethyl Ketone	27.	15.	5.5	14.	27.	13.	30.	37.	17.0	11.0
Methyl Isobutyl Ketone	2.0	0.20	0.057	-	2.0	0.29	5.7	0.36	0.14	0.0060
Methyl Propyl Ketone	-	-	-	-	-	0.090	-	0.10	-	-
Esters										
Isopropyl Acetate	-	-	-	-	-	-	0.25	-	-	-
Butyl Lactate	0.029	-	-	-	-	-	-	-	-	-
Cellosolve Acetate	-	-	-	-	-	-	-	0.10	-	-
Ethyl Acetate	0.39	0.13	0.12	0.067	0.39	0.074	7.1	0.030	0.14	0.034
Methyl Acetate	-	0.0028	0.0068	0.010	0.0079	0.017	-	0.015	0.050	0.012
Propyl Acetate	-	0.0028	-	-	-	-	-	-	-	-
Isobutyl Acetate	-	-	0.11	-	-	-	-	-	-	-
Misc. Class										
Acetonitrile	0.058	-	0.13	0.0020	0.029	0.013	0.12	0.025	0.029	0.00030
Dimethyl Sulfide	-	0.026	0.36	0.024	0.058	0.023	0.0016	0.028	0.084	0.088
Unknown	-	-	0.017	0.0013	-	0.077	-	0.00048	-	0.011
Unknown (EC)	-	-	0.050	-	-	-	-	0.0066	-	-
Total Weight (mg/m^3)	74.5	33.65	18.7	32.6	11.6	27.4	76.9	70.7	34.4	22.26

Results presented are totals from all cryogenic traps from 8 hours of trapping.

Table 2

Skylab AM/MDA

Grab Samples of Atmospheric Contaminants from Unmanned Altitude Test
Taken at Point B at Times Indicated
(mg/m^3)

Compound	MDA Center Before 84 Hr. Test	0 Hr.	4th Hr.	8th Hr.	12th Hr.	16th Hr.	20th Hr.	24th Hr.	28th Hr.	32nd Hr.	36th Hr.
Halocarbons											
1.1, 1-Trichloroethane	-	-	-	-	-	-	-	-	-	-	-
Carbon Tetrachloride	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	-	-	-	-	-	-	-	-	-	-	-
Chloroform				0.0099		1.3				6.2	
Dichlorobenzene		0.068		<0.0004	0.002	0.056		0.022		0.095	
Dichloroethane	-	-	-	-	-	-	-	-	-	-	-
Fluorochloroethylene	-	-	-	-	-	-	-	-	-	-	-
Freon 11	-	-	-	-	-	-	-	-	-	-	-
Freon 12	-	-	-	-	-	-	-	-	-	-	0.27
Freon 113	2.4	1.8	2.2	0.21	1.1	1.8	0.50	0.24	0.10	1.0	2.8
Methyl Chloride	-	-	-	-	-	-	-	-	-	-	-
Methyl Chloroform	0.14	4.1	0.16	0.0001	1.2		<0.004	0.79	<0.004	0.48	0.26
Methylene Chloride	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethylene	-	0.57	0.20	0.023	0.012	-	-	0.39	-	-	0.20
Trichloroethylene	0.08	0.46	2.9	0.33	2.3	8.6	<0.004	11.	<0.004	0.76	1.5
Vinylidene Chloride	-	-	-	-	-	-	-	-	-	-	0.016
Chlorodifluoroethylene	-	-	-	-	-	-	-	-	-	-	-
Aromatics											
Benzene	-	0.29	0.12	0.023	-	0.060	0.15	0.15	-	0.11	0.15
C-10 Aromatics	-	-	0.027	-	-	-	-	-	-	-	-
C-11 Aromatics	-	-	-	-	-	-	-	-	-	-	-
Cumene	-	-	-	-	-	-	-	-	-	-	-
Ethyl Benzene	-	0.091	-	-	-	-	-	-	-	-	-
Indene	-	-	-	-	-	-	-	-	-	-	-
Mesitylene	-	-	-	-	-	-	-	-	-	-	-
n-Propyl Benzene	-	-	-	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	-	-	-	-	-

Table 2 (Cont.)

Skylab AM/MDA

Grab Samples of Atmospheric Contaminants from Unmanned Altitude Test
Taken at Point B at Times Indicated
(mg/m^3)

Compound	40th Hr.	44th Hr.	48th Hr.	52nd Hr.	56th Hr.	60th Hr. *	68th Hr.	72nd Hr.	76th Hr.	80th Hr.	84th Hr.
Halocarbons											
1.1.1-Trichloroethane	-	-	-	-	-	-	-	-	-	-	-
Carbon Tetrachloride	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	-	-	-	-	-	-	-	-	-	-	-
Chloroform	0.068	-	-	2.8	1.3	-	1.4	-	2.2	-	-
Dichlorobenzene	0.0002	-	0.016	0.002	0.006	-	0.023	-	0.069	-	-
Dichloroethane	-	-	-	-	-	-	-	-	-	-	-
Fluorochloroethylene	-	-	-	-	-	-	-	-	-	-	-
Freon 11	0.01	0.0027	-	-	0.55	-	-	-	-	-	-
Freon 12	-	-	-	-	-	-	-	-	-	-	-
Freon 113	0.49	1.5	0.40	1.6	2.1	0.60	1.4	10.	2.5	0.73	3.2
Methyl Chloride	-	-	-	-	-	-	-	-	-	-	-
Methyl Chloroform	0.56	1.1	0.20	0.71	0.058	-	0.008	9.8	0.53	0.23	1.5
Methylene Chloride	0.99	0.0026	5.2	-	-	-	-	-	-	-	-
Tetrachloroethylene	0.18	0.10	16.	-	-	-	-	2.8	1.4	-	7.1
Trichloroethylene	3.8	3.9	6.6	7.9	158.	-	10.	4.5	2.9	1.6	8.6
Vinylidene Chloride	-	-	-	-	-	-	-	-	-	-	-
Chlorodifluoroethylene	-	-	-	-	-	-	-	-	-	-	-
Aromatics											
Benzene	0.11	0.56	2.2	1.8	0.22	-	0.045	-	0.37	-	0.21
C-10 Aromatics	-	-	-	-	-	-	-	0.40	-	-	-
C-11 Aromatics	-	-	-	-	-	-	-	-	0.056	-	0.04
Cumene	-	-	0.075	-	-	-	-	-	-	-	-
Ethyl Benzene	-	-	-	-	-	-	-	-	-	-	-
Indene	-	-	-	-	-	-	-	-	-	-	-
Mesitylene	-	-	0.044	-	-	-	-	-	-	-	-
n-Propyl Benzene	-	-	-	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	-	-	-	-	-

Table 2 (Cont.)

Skylab AM/MDA

Grab Samples of Atmospheric Contaminants from Unmanned Altitude Test
Taken at Point B at Times Indicated
(mg/m^3)

Compound	MDA Center Before 84 Hr. Test	0 Hr.	4th Hr.	8th Hr.	12th Hr.	16th Hr.	20th Hr.	24th Hr.	28th Hr.	32nd Hr.	36th Hr.
Toluene						0.036			1.3		0.37
Trimethyl Benzene	-	-	-	-	-	-	-	-	-	-	-
p-Xylene	2.6	0.17	0.33		0.045		0.33		0.34	0.14	0.031
o-Xylene	-	0.021	-	0.11	-	-	-	-	-	0.12	<0.004
m-Xylene	-	0.091	-	-	-	-	-	-	-	-	-
Aliphatics											
Acetylene	-	-	-	-	-	-	-	-	-	-	-
1 3-Butadiene	-	-	-	-	-	-	-	-	-	-	-
Butane	-	0.077	-	-	0.19	0.18	-	0.22	-	0.087	0.021
1-Butene	-	0.22	0.095	-	0.28	0.13	-	-	-	0.068	0.12
2-Butene (cis)	-	-	-	-	-	-	-	-	-	0.048	0.012
2-Butene (trans)	-	-	-	-	-	1.1	-	-	-	-	-
Cyclohexane	-	-	-	-	-	-	-	-	-	-	-
Cyclohexene	-	0.076	-	-	-	-	-	-	-	-	-
Cyclopentene	-	-	-	-	-	-	-	-	-	-	-
Dimethyl Cyclohexane	-	0.49	-	-	0.022	-	-	-	-	-	-
2, 3 Dimethyl Pentane	-	-	-	-	-	-	-	-	-	-	-
Ethane	-	-	-	-	0.20	-	-	-	-	0.012	-
Ethylene	-	0.051	-	-	-	-	-	-	-	-	-
n-Heptane	-	0.36	-	-	0.26	-	-	-	-	0.096	0.12
n-Hexane	-	-	-	-	-	-	-	-	-	-	-
Hexene	-	-	-	-	-	-	-	-	-	-	-
Isobutane	-	-	-	-	-	-	-	-	-	-	-
Isopentane	-	-	-	-	-	-	-	-	-	0.54	4.3
Isoprene	-	0.093	-	0.0084	0.26	0.052	-	-	-	0.034	-
Methyl Acetylene	-	-	-	-	-	-	-	-	-	-	-
Methyl Cyclohexane	-	-	-	-	-	-	-	-	-	0.096	0.12
Methyl Cyclopentane	-	-	-	-	0.08	-	-	-	-	-	-
1-Pentene	-	-	-	-	-	-	-	-	-	-	-
Propadiene	-	-	-	-	-	-	-	-	-	-	-

Table 2 (Cont.)

Skylab AM/MDA

Grab Samples of Atmospheric Contaminants from Unmanned Altitude Test
Taken at Point B at Times Indicated
(mg/m^3)

Compound	40th Hr.	44th Hr.	48th Hr.	52nd Hr.	56th Hr.	60th Hr.	* 68th Hr.	72nd Hr.	76th Hr.	80th Hr.	84th Hr.
Toluene	0.87	0.15	4.4	1.3	0.87	-	0.20	-	0.18	0.024	0.90
Trimethyl Benzene	-	-	-	-	-	-	-	-	-	-	-
p-Xylene	0.021	0.11	0.68	0.13	-	-	-	1.1	0.039	-	0.40
o-Xylene	0.015	0.066	0.34	0.053	0.11	-	0.057	-	0.046	-	-
m-Xylene	-	-	-	-	-	-	-	-	-	-	-
Aliphatics											
Acetylene	-	-	-	-	-	-	-	-	-	-	-
1 3-Butadiene	-	-	-	-	-	-	-	-	-	-	-
Butane	0.0055	0.025	0.036	0.083	0.15	-	0.12	1.8	0.045	0.23	1.2
1-Butene	-	-	-	0.083	0.15	-	0.12	-	0.014	-	-
2-Butene (cis)	-	-	-	0.033	-	-	-	-	-	-	-
2-Butene (trans)	-	-	-	-	-	-	-	-	-	-	-
Cyclohexane	-	-	-	-	-	-	-	-	-	-	-
Cyclohexene	-	-	-	-	-	-	-	-	-	-	-
Cyclopentene	-	-	-	-	-	-	-	-	-	-	-
Dimethyl Cyclohexane	-	-	-	0.21	-	-	-	-	0.29	-	-
2, 3 Dimethyl Pentane	-	-	-	-	-	-	-	-	-	-	-
Ethane	-	-	-	0.04	-	-	-	-	0.029	-	-
Ethylene	-	-	-	-	-	-	-	-	-	-	-
n-Heptane	-	-	-	0.035	0.042	-	0.095	-	-	-	-
n-Hexane	-	-	-	-	-	-	-	-	-	-	-
Hexene	-	-	-	0.23	-	-	-	-	-	-	-
Isobutane	-	-	-	-	-	-	-	-	-	-	-
Isopentane	0.017	-	-	5.0	-	-	-	-	0.64	-	-
Isoprene	0.024	-	-	-	0.16	-	-	-	1.1	<0.004	-
Methyl Acetylene	-	-	-	-	-	-	-	-	-	-	-
Methyl Cyclohexane	-	0.54	-	-	0.28	-	0.095	-	1.1	0.04	-
Methyl Cyclopentane	-	-	-	-	-	-	-	-	-	-	-
1-Pentene	-	-	-	-	-	-	-	-	-	-	-
Propadiene	-	-	-	-	-	-	-	-	-	-	-

Table 2 (Cont.)

Skylab AM/MDA

Grab Samples of Atmospheric Contaminants from Unmanned Altitude Test
Taken at Point B at Times Indicated
(mg/m^3)

Compound	MDA Center Before 84 Hr. Test	0 Hr.	4th Hr.	8th Hr.	12th Hr.	16th Hr.	20th Hr.	24th Hr.	28th Hr.	32nd Hr.	36th Hr.
Propane	-	-	-	-	-	-	-	-	-	-	0.009
Propylene	-	-	-	-	-	-	-	-	-	0.005	0.012
n-Octane	-	-	-	-	-	-	-	-	-	-	-
Trimethyl Hexane	-	-	-	-	-	-	-	-	-	-	-
Heterocyclics											
Dioxane	-	-	-	-	-	-	-	-	-	0.25	0.033
Furan	-	-	-	-	0.091	-	-	-	-	-	-
Tetrahydrofuran	-	-	-	-	-	-	-	-	-	-	-
Alcohols											
n-Amyl Alcohol	-	-	-	-	-	-	-	-	-	-	-
Allyl Alcohol	-	0.004	0.0092	-	0.006	-	-	<0.004	-	0.10	0.038
n-Butyl Alcohol	-	-	0.17	0.037	0.12	-	-	0.59	-	0.29	-
s-Butyl Alcohol	-	-	-	-	-	-	-	-	-	-	-
Capryl Alcohol	-	-	-	-	0.018	-	-	-	-	-	0.004
Cyclohexyl Alcohol	-	-	0 029	-	-	-	-	-	-	-	-
Ethyl Alcohol	-	0.27	-	0.18	0.70	1.4	-	-	-	0.21	0.33
Ethylene Glycol	-	-	-	-	-	-	-	-	-	-	-
2-Ethyl Hexyl Alcohol	-	0 027	0.001	0.028	0.030	-	-	-	-	0.12	-
2-Hexyl Alcohol	-	-	-	-	-	-	-	-	-	-	-
Isoamyl Alcohol	-	-	-	0.0035	-	-	-	0.037	-	0.096	0.015
Isobutyl Alcohol	2.4	-	0.08	-	-	-	2.7	-	2.6	-	0.19
Isopropyl Alcohol	0.20	0.16	0.096	0.050	0.041	1.1	<0.004	-	-	-	-
Methyl Alcohol	2.0	-	-	-	0.085	-	0.08	-	<0.004	-	-
n-Propyl Alcohol	0.10	-	0.54	-	-	-	0.09	0.012	<0.004	0.26	0.22
t-Butyl Alcohol	-	-	-	-	-	-	-	-	-	-	-
Aldehydes											
Acetaldehyde	-	-	-	0.23	-	-	-	-	-	-	-
Acrolein	-	-	-	-	-	0.15	-	0.87	-	-	-
Propionaldehyde	-	-	-	-	-	-	-	-	-	-	-

Table 2 (Cont.)

Skylab AM/MDA

Grab Samples of Atmospheric Contaminants from Unmanned Altitude Test
Taken at Point B at Times Indicated
(mg/m^3)

Compound	40th Hr.	44th Hr.	48th Hr.	52nd Hr.	56th Hr.	60th Hr.	* 68th Hr.	72nd Hr.	76th Hr.	80th Hr.	84th Hr.
Propane	-	0.095	-	-	-	-	-	-	-	-	-
Propylene	-	-	-	-	-	-	-	-	-	-	-
n-Octane	-	-	-	-	-	-	-	-	-	-	-
Trimethyl Hexane	-	-	-	0.11	-	-	-	-	-	-	-
Heterocyclics											
Dioxane	-	0.032	2.3	0.025	-	-	0.002	-	0.39	-	-
Furan	-	0.14	-	0.051	-	-	0.009	-	-	-	0.38
Tetrahydrofuran	-	-	-	-	-	-	-	-	-	-	-
Alcohols											
n-Amyl Alcohol	-	<0.0004	0.072	-	-	-	-	-	-	-	-
Allyl Alcohol	-	-	-	-	0.084	-	-	0.80	0.010	0.22	0.70
n-Butyl Alcohol	0.052	0.090	0.13	0.063	-	-	-	0.70	-	0.004	0.45
s-Butyl Alcohol	-	-	-	-	-	-	-	-	0.046	-	-
Capryl Alcohol	-	-	0.0011	-	-	-	-	-	0.058	<0.004	-
Cyclohexyl Alcohol	-	0.016	0.16	-	0.026	-	-	0.60	0.19	0.033	-
Ethyl Alcohol	0.10	0.34	-	0.99	6.3	-	-	-	2.2	-	20.
Ethylene Glycol	-	-	-	-	-	-	-	-	-	-	-
2-Ethyl Hexyl Alcohol	0.0039	0.0049	0.067	0.026	0.011	-	0.035	-	-	-	-
2-Hexyl Alcohol	-	-	-	-	-	-	-	-	-	-	-
Isoamyl Alcohol	0.0005	-	0.15	0.005	0.0047	-	0.016	-	0.033	<0.004	-
Isobutyl Alcohol	0.055	0.24	0.30	-	0.84	-	-	4.5	0.38	0.047	2.0
Isopropyl Alcohol	0.12	0.38	3.8	-	7.6	0.10	-	0.72	0.75	0.22	15.3
Methyl Alcohol	0.16	3.6	-	-	-	-	-	-	-	-	-
n-Propyl Alcohol	-	0.97	-	0.40	-	-	0.003	-	0.16	-	-
t-Butyl Alcohol	-	-	-	-	-	-	-	-	-	-	-
Aldehydes											
Acetaldehyde	-	-	-	-	3.2	-	-	-	3.8	-	0.30
Acrolein	-	0.84	-	-	-	-	-	-	-	-	-
Propionaldehyde	1.1	-	-	-	-	-	-	-	-	-	-

Table 2 (Cont.)

Skylab AM/MDA

Grab Samples of Atmospheric Contaminants from Unmanned Altitude Test
Taken at Point B at Times Indicated
(mg/m^3)

Compound	MDA Center Before 84 Hr. Test	0 Hr.	4th Hr.	8th Hr.	12th Hr.	16th Hr.	20th Hr.	24th Hr.	28th Hr.	32nd Hr.	36th Hr.
Ketones											
Acetone	0.70	0.36	0.79	0.021	2.4	2.0	0.11	4.2	<0.004	1.1	2.8
Methyl Ethyl Ketone	1.5	0.92	1.5	-	0.27	-	<0.004	0.20	0.08	74.	0.92
Methyl Isobutyl Ketone	-	0.14	-	-	2.2	0.16	-	1.1	-	-	1.1
Methyl Propyl Ketone	-	-	-	-	-	-	-	-	-	-	-
Esters											
Isopropyl Acetate	-	-	-	-	-	-	-	-	-	-	-
Butyl Lactate	-	-	-	-	-	-	-	-	-	0.006	-
Cellosolve Acetate	-	-	-	-	-	-	-	-	-	-	-
Ethyl Acetate	-	0.042	-	-	-	-	-	-	-	-	-
Methyl Acetate	-	-	-	-	-	-	-	0.10	-	-	-
Propyl Acetate	-	-	-	-	-	-	-	-	-	-	-
Isobutyl Acetate	-	-	-	-	-	-	-	-	-	-	-
Misc. Class											
Acetonitrile	-	-	-	-	-	0.036	-	-	-	-	0.19
Dimethyl Sulfide	-	-	-	-	-	-	-	-	-	-	-
Unknown	-	-	-	-	-	-	-	-	-	-	-
Unknown (EC)	-	-	-	-	-	-	-	-	-	-	-
Major Components(Mol. %)											
Nitrogen	69.3	24.5	26.8	31.4	30.2	27.9	28.0	25.8	25.7	31.5	26.4
Oxygen	29.8	75.2	72.8	68.2	69.5	71.7	71.6	73.9	73.4	68.1	76.6
Argon	0.80	0.34	0.34	0.36	0.32	0.31	0.31	0.28	0.89	0.34	0.30
Carbon Dioxide	0.10	0.02	0.04	0.09	0.06	0.08	0.07	0.08	0.0	0.03	0.05
Pressure (psig)	0	1.5	13.5	18.0	21.5	0	16.0	20.0	0	-	21.0

Table 2 (Cont.)

Skylab AM/MDA

Grab Samples of Atmospheric Contaminants from Unmanned Altitude Test
Taken at Point B at Times Indicated
(mg/m^3)

Compound	40th Hr.	44th Hr.	48th Hr.	52nd Hr.	56th Hr.	60th Hr.	* 68th Hr.	72nd Hr.	76th Hr.	80th Hr.	84th Hr.
Ketones											
Acetone	1.5	4.1	3.1	2.5	2.4	-	0.20	13.	6.2	0.50	3.3
Methyl Ethyl Ketone	1.9	6.0	11.0	13.0	131.	-	0.002	210.	12.0	4.2	5.7
Methyl Isobutyl Ketone	-	2.5	0.26	-	1.2	-	-	24.	4.0	0.31	4.0
Methyl Propyl Ketone	-	0.12	-	-	-	-	-	-	0.50	-	-
Esters											
Isopropyl Acetate	-	-	-	-	-	-	-	2.4	-	0.069	0.06
Butyl Lactate	-	-	-	-	-	-	-	-	-	-	-
Cellosolve Acetate	-	-	-	-	-	-	-	-	-	0.046	0.090
Ethyl Acetate	-	-	-	-	-	-	-	-	-	-	-
Methyl Acetate	-	0.29	-	-	-	-	-	-	-	-	-
Propyl Acetate	-	-	6.3	-	-	-	-	-	-	0.081	4.5
Isobutyl Acetate	-	-	-	-	-	-	-	2.8	-	-	-
Misc. Class											
Acetonitrile	-	-	-	-	-	-	-	-	-	-	-
Dimethyl Sulfide	1.9	-	-	-	-	-	-	-	-	-	-
Unknown	-	-	-	-	-	-	-	-	-	-	-
Unknown (EC)	-	-	-	-	-	-	-	-	-	-	-
Major Components(Mol. %)											
Nitrogen	23.1	27.5	25.1	28.0	26.1	41.2	26.8	26.3	24.1	25.4	29.1
Oxygen	76.6	72.1	74.5	71.7	73.6	58.3	72.8	73.4	75.5	74.4	70.5
Argon	0.27	0.34	0.29	0.29	0.26	0.45	0.27	0.27	0.26	0.24	0.31
Carbon Dioxide	0.03	0.04	0.04	0.04	0.08	-	0.08	-	0.02	-	-
Pressure (psig)	10.5	18.	1.5	-	1.0	0	21.	24.	15.	-	15.

*64th Hour Sample Lost

Table 3

Skylab AM/MDA

Grab Samples of Atmospheric Contaminants from Unmanned Altitude Test
Taken at Point A
(mg/m^3)

Compound	0 Hr.	12th Hr.	24th Hr.	36th Hr.	48th Hr.	60th Hr.	72nd Hr.	84th Hr.
Halocarbons								
1.1, 1-Trichloroethane	-	-	-	-	-	-	-	-
Carbon Tetrachloride	-	-	-	-	-	-	-	-
Chlorobenzene	-	-	-	-	-	-	-	-
Chloroform	2.3	1.3	-	0.96	0.13	4.1	0.60	0.44
Dichlorobenzene	0.035	0.004	0.022	0.020	0.0041	0.78	0.007	-
Dichloroethane	-	-	-	-	-	-	-	-
Fluorochloroethylene	-	-	-	-	-	-	-	-
Freon 11	-	-	-	-	0.013	-	-	-
Freon 12	0.08	-	-	-	-	-	-	-
Freon 113	14.	5.7	0.24	2.3	3.9	3.7	7.9	0.36
Methyl Chloride	-	-	-	-	-	-	-	-
Methyl Chloroform	2.3	10.	0.39	0.44	1.2	2.5	5.0	-
Methylene Chloride	9.6	0.078	-	-	0.0063	-	-	-
Tetrachloroethylene	-	0.005	0.21	-	1.2	-	-	-
Trichloroethylene	8.0	7.3	6.0	5.2	1.5	11.	6.6	1.0
Vinylidene Chloride	0.072	-	-	-	-	-	0.87	-
Chlorodifluoroethylene	-	-	0.0058	-	-	-	-	-
Aromatics								
Benzene	1.4	0.44	0.13	0.073	1.2	0.72	-	0.84
C-10 Aromatics	0.04	-	-	-	-	-	-	-
C-11 Aromatics	-	-	-	-	0.0004	-	-	-
Cumene	-	-	0.015	-	-	-	-	-
Ethyl Benzene	-	-	-	-	0.0016	-	-	-
Indene	-	-	-	-	-	-	-	-
Mesitylene	-	-	-	-	-	-	-	-
n-Propyl Benzene	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	-	-

Table 3 (Cont.)

Skylab AM/MDA

Grab Samples of Atmospheric Contaminants from Unmanned Altitude Test
Taken at Point A
(mg/m^3)

Compound	0 Hr.	12th Hr.	24th Hr.	36th Hr.	48th Hr.	60th Hr.	72nd Hr.	84th Hr.
Toluene	0.62	-	0.93	0.85	2.1	1.3	0.12	-
Trimethyl Benzene	-	-	-	-	-	-	-	-
p-Xylene	0.066	0.37	0.019	0.018	0.33	0.23	0.12	-
o-Xylene	0.024	0.005	0.025	0.009	0.29	0.005	0.038	-
m-Xylene	-	-	-	-	-	-	-	-
Aliphatics								
Acetylene	-	-	-	-	-	-	-	-
1 3-Butadiene	-	-	-	-	-	-	-	-
Butane	1.6	0.062	0.039	0.076	0.053	0.20	0.10	0.12
1-Butene	0.42	0.062	0.33	0.076	-	0.20	0.13	0.10
2-Butene (cis)	0.57	0.45	-	-	-	-	0.13	-
2-Butene (trans)	-	0.56	-	-	-	-	-	-
Cyclohexane	-	-	-	-	-	-	-	-
Cyclohexene	0.48	-	-	-	-	-	-	-
Cyclopentene	0.25	-	-	-	-	-	-	-
Dimethyl Cyclohexane	0.092	-	-	-	-	-	0.18	-
2, 3 Dimethyl Pentane	-	-	<0.004	-	-	-	-	-
Ethane	-	-	0.019	-	0.012	-	-	0.11
Ethylene	-	-	0.019	-	-	-	-	-
n-Heptane	-	-	-	0.25	-	0.45	-	-
n-Hexane	-	0.23	-	-	-	-	-	-
Hexene	-	-	-	-	-	-	-	-
Isobutane	-	-	-	-	-	-	-	-
Isopentane	-	0.017	-	-	-	0.22	0.13	1.1
Isoprene	2.7	-	0.51	0.021	0.04	0.075	1.0	-
Methyl Acetylene	-	-	-	-	-	-	-	-
Methyl Cyclohexane	0.36	-	-	-	0.71	0.45	-	-
Methyl Cyclopentane	-	-	-	-	-	-	-	-
1-Pentene	-	-	-	-	-	-	-	-
Propadiene	-	-	-	-	-	-	-	-

Table 3 (Cont.)
Skylab AM/MDA

Grab Samples of Atmospheric Contaminants from Unmanned Altitude Test
Taken at Point A
(mg/m^3)

Compound	0 Hr.	12th Hr.	24th Hr.	36th Hr.	48th Hr.	60th Hr.	72nd Hr.	84th Hr.
Propane	-	-	0.020	-	0.013	-	-	-
Propylene	-	-	0.012	-	-	-	-	-
n-Octane	-	-	-	-	-	-	-	-
Trimethyl Hexane	-	-	-	-	-	-	-	-
Heterocyclics								
Dioxane	0.38	-	-	-	0.34	0.40	-	<0.004
Furan	-	-	0.019	-	-	0.27	-	-
Tetrahydrofuran	-	-	-	-	-	-	-	-
Alcohols								
n-Amyl Alcohol	-	-	-	-	0.0059	-	-	-
Allyl Alcohol	0.023	-	0.014	0.012	0.0028	0.12	-	0.45
n-Butyl Alcohol	0.061	-	0.046	-	0.42	-	0.11	-
s-Butyl Alcohol	-	-	-	-	0.37	-	-	-
Capryl Alcohol	-	-	0.013	-	0.0011	-	-	-
Cyclohexyl Alcohol	-	-	-	-	0.16	-	-	-
Ethyl Alcohol	0.80	0.52	0.051	-	-	0.80	3.0	0.63
Ethylene Glycol	-	-	-	0.14	1.3	-	-	-
2-Ethyl Hexyl Alcohol	0.042	-	0.025	0.010	0.067	-	0.024	-
2-Hexyl Alcohol	-	-	-	-	-	-	-	-
Isoamyl Alcohol	-	0.0023	-	0.032	0.11	0.029	-	-
Isobutyl Alcohol	0.85	-	0.019	-	0.30	-	-	-
Isopropyl Alcohol	-	1.4	0.051	-	1.3	0.72	0.29	-
Methyl Alcohol	-	0.13	-	0.45	-	-	-	-
n-Propyl Alcohol	1.6	-	<0.004	-	0.035	-	1.1	0.76
t-Butyl Alcohol	-	-	-	-	-	-	-	-
Aldehydes								
Acetaldehyde	-	0.057	-	-	0.84	-	-	-
Acrolein	-	-	-	-	1.1	-	-	-
Propionaldehyde	-	-	-	-	-	-	-	-

Table 3 (Cont.)
Skylab AM/MDA

Grab Samples of Atmospheric Contaminants from Unmanned Altitude Test
Taken at Point A
(mg/m^3)

Compound	0 Hr.	12th Hr.	24th Hr.	36th Hr.	48th Hr.	60th Hr.	72nd Hr.	84th Hr.
Ketones								
Acetone	9.7	2.0	3.2	2.9	3.1	2.8	-	2.7
Methyl Ethyl Ketone	0.49	-	1.5	0.50	11.0	16.	-	0.050
Methyl Isobutyl Ketone	-	-	-	-	0.26	-	2.4	0.61
Methyl Propyl Ketone	-	-	-	-	-	-	-	-
Esters								
Isopropyl Acetate	-	-	-	-	-	1.9	0.006	-
Butyl Lactate	-	-	-	-	-	-	-	-
Cellosolve Acetate	-	-	-	-	0.014	-	-	-
Ethyl Acetate	-	-	-	-	-	-	-	-
Methyl Acetate	-	-	-	-	0.36	-	-	-
Propyl Acetate	-	-	-	-	-	-	-	-
Isobutyl Acetate	-	-	-	-	-	-	-	-
Misc. Class								
Acetonitrile	-	-	-	-	-	-	-	-
Dimethyl Sulfide	-	-	-	0.38	0.11	-	-	-
Unknown	-	-	-	-	-	-	-	-
Unknown (EC)	-	-	-	-	-	-	-	-
Major Components(Mol. %)								
Nitrogen	24.6	37.5	29.5	31.1	28.9	-	-	-
Oxygen	74.6	62.0	70.2	68.5	70.7	-	-	-
Argon	0.31	0.43	0.32	0.35	0.33	-	-	-
Carbon Dioxide	0.06	0.09	0.08	0.07	0.09	-	-	-
Pressure (psig)	16.5	15.0	20.0	3.	23.5	-	-	-

Table 4

Skylab AM/MDA

Grab Samples of Atmospheric Contaminants from Unmanned Altitude Test
Taken at Point C
(mg/m^3)

Compound	0 Hr.	12th Hr.	24th Hr.	36th Hr.	48th Hr.	60th Hr.	72nd Hr.	84th Hr.
Halocarbons								
1.1.1-Trichloroethane	-	-	-	-	-	-	-	-
Carbon Tetrachloride	-	-	-	-	-	-	-	-
Chlorobenzene	-	0.083	-	-	-	-	-	-
Chloroform	2.4	12.	-	0.16	0.0011	6.6	0.16	1.2
Dichlorobenzene	-	0.034	-	0.0079	0.057	0.094	0.10	0.056
Dichloroethane	-	-	-	0.18	-	-	-	-
Fluorochloroethylene	-	-	-	-	-	-	-	-
Freon 11	-	-	-	1.2	-	-	-	-
Freon 12	1.8	0.022	0.041	-	-	-	0.025	-
Freon 113	1.8	1.1	2.6	8.9	5.3	0.46	2.3	3.1
Methyl Chloride	-	-	-	-	-	-	-	-
Methyl Chloroform	0.70	3.2	0.26	1.3	0.80	0.57	-	0.39
Methylene Chloride	-	9.0	-	-	5.2	-	-	-
Tetrachloroethylene	0.29	-	0.31	0.50	1.7	-	-	-
Trichloroethylene	8.7	5.2	7.9	26.	3.7	0.81	2.2	3.9
Vinylidene Chloride	-	-	-	-	-	-	-	-
Chlorodifluoroethylene	-	-	-	-	-	-	-	-
Aromatics								
Benzene	2.7	0.22	0.079	0.11	5.1	0.20	0.28	-
C-10 Aromatics	-	-	-	-	-	-	-	-
C-11 Aromatics	-	-	-	-	-	-	-	-
Cumene	-	-	-	0.38	-	-	-	-
Ethyl Benzene	-	-	-	-	-	-	-	-
Indene	-	-	-	-	-	-	-	-
Mesitylene	-	-	-	0.15	-	-	-	-
n-Propyl Benzene	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	-	-

Table 4 (Cont.)

Skylab AM/MDA

Grab Samples of Atmospheric Contaminants from Unmanned Altitude Test
Taken at Point C
(mg/m^3)

Compound	0 Hr.	12th Hr.	24th Hr.	36th Hr.	48th Hr.	60th Hr.	72nd Hr.	84th Hr.
Toluene	-	0.12	-	0.87	0.61	1.3	2.0	0.16
Trimethyl Benzene	-	-	-	-	-	-	-	-
p-Xylene	-	0.045	0.050	0.46	0.24	0.22	0.38	-
o-Xylene	0.45	0.094	0.15	0.47	0.14	-	0.020	-
m-Xylene	-	-	-	-	-	-	-	-
Aliphatics								
Acetylene	-	-	-	-	-	-	-	-
1 3-Butadiene	-	-	-	-	-	-	-	-
Butane	0.16	0.71	0.18	-	0.54	0.13	0.14	0.025
1-Butene	0.28	0.64	0.29	-	-	0.13	0.64	0.019
2-Butene (cis)	0.12	0.56	-	-	0.0004	-	0.033	0.031
2-Butene (trans)	-	-	-	0.11	-	-	-	-
Cyclohexane	-	-	-	-	-	-	-	-
Cyclohexene	-	-	-	-	-	-	-	-
Cyclopentene	-	-	-	-	-	-	-	-
Dimethyl Cyclohexane	-	-	-	-	-	-	-	-
2, 3 Dimethyl Pentane	-	-	-	-	-	-	-	-
Ethane	-	-	0.18	-	-	-	-	0.059
Ethylene	-	-	-	-	-	-	-	-
n-Heptane	-	0.24	-	-	-	0.056	-	-
n-Hexane	-	-	-	-	-	-	-	-
Hexene	-	-	-	-	-	-	-	-
Isobutane	-	-	-	-	-	-	-	-
Isopentane	-	-	-	-	-	-	-	-
Isoprene	0.15	-	0.029	0.024	0.068	0.31	0.048	-
Methyl Acetylene	-	-	-	-	-	-	-	-
Methyl Cyclohexane	0.28	0.24	0.16	-	0.27	0.056	0.12	-
Methyl Cyclopentane	-	-	-	-	-	-	-	-
1-Pentene	-	-	-	-	-	-	0.31	-
Propadiene	-	-	-	-	-	-	-	-

Table 4 (Cont.)

Skylab AM/MDA

Grab Samples of Atmospheric Contaminants from Unmanned Altitude Test
Taken at Point C
(mg/m^3)

Compound	0 Hr.	12th Hr.	24th Hr.	36th Hr.	48th Hr.	60th Hr.	72nd Hr.	84th Hr.
Propane	-	-	-	-	-	-	-	-
Propylene	-	-	-	-	-	-	-	-
n-Octane	-	0.34	-	-	-	-	-	-
Trimethyl Hexane	-	-	-	-	-	-	-	-
Heterocyclics								
Dioxane	-	0.096	-	0.84	0.75	0.68	0.027	-
Furan	0.013	-	-	0.82	0.20	0.039	-	-
Tetrahydrofuran	-	-	-	-	-	-	-	-
Alcohols								
n-Amyl Alcohol	0.015	-	-	0.11	0.0021	0.009	-	-
Allyl Alcohol	-	-	0.024	-	-	0.091	0.010	-
n-Butyl Alcohol	-	-	-	0.43	0.13	0.63	-	-
s-Butyl Alcohol	-	-	-	3.0	-	-	-	-
Capryl Alcohol	-	-	0.017	-	-	-	-	-
Cyclohexyl Alcohol	-	-	-	0.043	0.053	-	-	-
Ethyl Alcohol	0.16	0.17	0.033	-	-	0.99	0.64	0.14
Ethylene Glycol	-	-	-	27.	1.1	-	-	-
2-Ethyl Hexyl Alcohol	-	-	0.028	0.051	0.032	0.22	0.26	-
2-Hexyl Alcohol	-	-	-	-	-	-	-	-
Isoamyl Alcohol	0.002	-	-	0.24	0.0004	0.020	0.029	-
Isobutyl Alcohol	0.19	0.11	0.008	0.38	0.16	-	-	-
Isopropyl Alcohol	-	-	-	-	0.65	1.7	-	-
Methyl Alcohol	-	-	-	-	-	-	-	0.22
n-Propyl Alcohol	-	-	-	6.3	0.23	0.52	-	-
t-Butyl Alcohol	-	-	-	2.0	-	-	-	-
Aldehydes								
Acetaldehyde	-	-	-	7.4	-	-	-	0.093
Acrolein	-	-	-	-	-	-	-	-
Propionaldehyde	-	-	-	-	-	-	-	-

Table 4 (Cont.)

Skylab AM/MDA

Grab Samples of Atmospheric Contaminants from Unmanned Altitude Test
Taken at Point C
(mg/m^3)

Compound	0 Hr.	12th Hr.	24th Hr.	36th Hr.	48th Hr.	60th Hr.	72nd Hr.	84th Hr.
Ketones								
Acetone	1.9	2.3	2.9	9.2	5.6	1.4	6.0	2.3
Methyl Ethyl Ketone	-	0.13	-	-	-	20.	0.056	0.21
Methyl Isobutyl Ketone	0.07	0.29	2.0	205.	4.0	-	0.18	-
Methyl Propyl Ketone	-	-	-	4.0	0.30	-	-	-
Esters								
Isopropyl Acetate	-	-	-	2.0	-	-	-	-
Butyl Lactate	-	-	-	-	-	-	-	-
Cellosolve Acetate	-	-	-	-	0.001	-	-	-
Ethyl Acetate	-	-	-	0.70	-	-	-	-
Methyl Acetate	-	-	-	-	0.11	-	-	-
Propyl Acetate	-	-	-	-	-	-	-	-
Isobutyl Acetate	-	-	-	-	-	0.021	-	0.093
Misc. Class								
Acetonitrile	-	-	-	1.0	-	-	-	-
Dimethyl Sulfide	-	-	-	1.9	0.32	-	-	-
Unknown	-	-	-	-	-	-	-	-
Unknown (EC)	-	-	-	-	-	-	-	-
Major Component(Mol. %)								
Nitrogen	25.6	40.0	24.4	28.2	28.8	-	-	-
Oxygen	74.1	59.5	75.2	71.4	70.8	-	-	-
Argon	0.34	0.45	0.27	0.32	0.33	-	-	-
Carbon Dioxide	0.06	0.08	0.11	0.07	0.08	-	-	-
Pressure (psig)	16.0	18.0	16.	0.	9.0	-	-	-

Table 5

Methane and Carbon Monoxide Analyses on
Selected AM/MDA Atmospheric Samples

Sample Position	Time of Sampling	CH_4, ppm	CO, ppm
Grab B	12 Hr.	5.5	2.2
Grab A	24 Hr.	5.4	4.6
Grab B	32 Hr.	6.2	3.5
Grab B	36 Hr.	6.6	4.8
Grab C	36 Hr.	4.2	28.4
Grab B	40 Hr.	6.9	4.3
Grab B	44 Hr.	6.3	5.0
Grab A	48 Hr.	4.5	10.7
Grab B	48 Hr.	6.1	-
Grab C	48 Hr.	5.7	14.0
Grab A	84 Hr.	11.2	23.0

TABLE 6

Skylab AM/MDA

Charcoal Samples of Atmospheric Contaminants from Unmanned Altitude Run

(μg/g of charcoal)

Compound	Cryogenic System Charcoal Trap	Blank Charcoal	Canister 30-111	Canister 30-116
Halocarbons				
Chloroform	0.0012	-	0.00004	0.019
Dichlorobenzene	-	-	0.0070	-
Dichlorodifluoroethylene	-	0.00004	0.0093	0.029
Ethyl Chloride	-	-	0.0019	0.00038
Fluorochloroethylene	-	-	0.0064	0.00032
Freon 11	9.1	-	0.068	0.19
Freon 12	0.0023	0.00069	-	-
Freon 21	-	-	0.00049	0.00003
Freon 113	0.19	0.0048	0.92	14.
Freon 114	0.015	-	0.0026	-
Methyl Chloride	0.0058	-	-	-
Methyl Chloroform	0.10	0.011	0.092	0.066
Methylene Chloride	1.1	-	0.021	0.0011
Tetrachloroethylene	-	-	0.00097	-
Tetrafluorochloroethane	-	-	0.058	0.018
Trichloroethylene	-	-	0.0013	0.013
Trifluorochloroethylene	-	-	0.026	0.14
Vinylidene Chloride	-	-	0.020	0.00007
Aromatics				
Benzene	0.054	0.0025	0.16	0.083
C-9 Atomatics	0.0097	-	-	-
Ethyl Benzene	0.0063	0.00099	0.017	0.00040
Indene	-	-	-	0.00008
Toluene	0.058	0.029	0.35	0.080
m-Xylene	-	-	0.0012	0.00040
o-Xylene	-	-	0.0039	-
p-Xylene	-	-	0.0010	-
Aliphatics				
Acetylene	-	-	0.00058	-
Butane	0.0062	0.00050	0.11	0.011
1-Butene	0.027	0.0018	0.16	0.031
2-Butene (cis)	0.0035	-	0.014	0.0039

TABLE 6 (cont.)

Skylab AM/MDA

Charcoal Samples of Atmospheric Contaminants from Unmanned Altitude Run

(μg/g of charcoal)

Compound	Cryogenic System Charcoal Trap	Blank Charcoal	Canister 30-111	Canister 30-116
2-Butene (trans)	0.0077	-	-	-
2,2-Dimethylbutane	0.029	-	-	-
Ethane	-	-	0.00093	-
Ethylene	-	-	0.00039	-
n-Heptane	-	-	0.14	1.0
Hexane	-	-	0.011	0.00029
Isobutane	-	0.0018	0.025	0.00004
Isopentane	-	-	0.0047	-
Isoprene	0.0018	0.00053	0.0097	0.0067
Methyl Cyclohexene	0.0031	-	-	-
Methyl Cyclopentane	0.013	-	-	-
Propane	0.058	0.00011	2.3	0.11
Propylene	0.022	0.00066	0.18	0.032
Trimethyl Hexane	-	-	0.031	-
Heterocyclics				
Dioxane	0.0026	-	-	-
Furan	-	-	0.15	-
Alcohols				
Methyl Alcohol	2.3	0.00012	0.0020	-
Ethyl Alcohol	0.036	0.018	1.8	0.60
Isopropyl Alcohol	0.75	-	0.51	0.024
n-Propyl Alcohol	-	-	0.00064	-
Aldehydes				
Acetaldehyde	0.032	-	-	-
Ketones				
Acetone	0.65	0.016	0.48	0.14
Methyl Ethyl Ketone	0.12	-	0.017	0.0051
Esters				
Ethyl Acetate	0.0051	-	0.015	-
Total Weight (μg/g charcoal)	14.7	0.089	7.76	16.4

TABLE 7

Supply Gas for Skylab AM/MDA

Compound	Oxygen ug/l	Nitrogen ug/l
Halocarbons		
Freon 113	0.22	0.25
Chloroform	-	0.32
Trichloroethylene	-	0.62
Vinylidene Chloride	-	0.084
Aromatics		
Benzene	0.068	-
Toluene	1.0	0.030
o-Xylene	-	0.34
p-Xylene	0.092	-
Aliphatics		
Butane	-	0.074
Cyclohexene	-	0.014
Ethane	0.00056	-
Hexane	-	0.057
Methylcyclopentane	0.091	-
n-Octane	-	0.11
Propane	-	0.31
Heterocyclics		
Furan	0.026	-
Tetrahydrofuran	-	0.093
Dioxane	-	0.18
Alcohols		
Methyl Alcohol	0.063	2.4
Ethyl Alcohol	1.5	1.8
n-Propyl Alcohol	0.12	-
Isopropyl Alcohol	1.3	1.4
Isobutyl Alcohol	0.10	-
t-butyl Alcohol	-	0.11

TABLE 7 (cont.)

Supply Gas for Skylab AM/MDA

Compound	Oxygen ug/l	Nitrogen ug/l
Aldehydes		
Acetaldehyde	0.16	0.049
Benzaldehyde	-	0.0093
Ketones		
Acetone	3.5	0.48
Methyl Ethyl Ketone	16.0	0.078